

Homework

Due by 23:59, September 4, 2026

Submission instructions: replicable code + pdf file with solutions to problems and plots/tables for Problem 3 (compiled using $\text{\LaTeX}$)

Problem 1. A representative household i faces the following maximization problem:

$$\begin{aligned} \max_{C_{i,t}, B_{i,t+1}, W_{i,t}} & \left(\Xi_t \frac{(C_{i,t} - h C_{t-1})^{1-\sigma}}{1-\sigma} - \Phi_t \frac{\omega}{1+\nu} L_{i,t}^{1+\nu} - \frac{\psi_w}{2} \left[\frac{W_{i,t}}{\Pi_{t-1}^{\epsilon_w} W_{i,t-1}} - 1 \right]^2 \right) + \\ & + \mathbb{E}_t \left[\sum_{s=t+1}^{\infty} \beta^{s-t} \left(\Xi_s \frac{(C_{i,s} - h C_{s-1})^{1-\sigma}}{1-\sigma} - \Phi_s \frac{\omega}{1+\nu} L_{i,s}^{1+\nu} - \frac{\psi_w}{2} \left[\frac{W_{i,s}}{\Pi_{s-1}^{\epsilon_w} W_{i,s-1}} - 1 \right]^2 \right) \right] \\ \text{s.t.} \quad & P_t C_{i,t} + \frac{B_{i,t+1}}{1+i_t} + T_t = B_{i,t} + W_{i,t} L_{i,t} + D_t, \quad \text{where} \quad L_{i,t} = \left(\frac{W_{i,t}}{W_t} \right)^{-\epsilon_{w,t}} L_t \end{aligned}$$

The notation is standard. Explain the intuition behind this problem and the notation of both variables and parameters. Find first order conditions (FOCs), log-linearize, and check yourself using the provided codes.

Problem 2. Briefly answer the following questions:

- (i) Explain what DSGE modelling stands for. What are the main principles, advantages, and disadvantages of the DSGE modelling?
- (ii) How do we specify a prior for a DSGE model estimation? For which parameters are you going to use Beta prior, Gamma prior, and Inverse Gamma prior? What is the difference between the last two and when is it useful?
- (iii) Given prior and posterior, how are you going to check whether data is informative? What cases can you face and what are you going to do in each of them?

Problem 3. Given the provided `DSGE_RE_bayesian_estimation.mod` and `RE_medium_data.mat` files, investigate how bayesian estimation of the DSGE model is implemented.

- (i) Does the number of equations equal the number of variables? Why is it important? Complement the mod file with the missing equation, which was derived in the lecture.
- (ii) Report the results you obtain. How do you assess them? What can be improved¹?

¹You do not need to implement the improvements you suggest